ACR–AIUM–SPR–SRU PRACTICE PARAMETER FOR THE PERFORMANCE AND INTERPRETATION OF DIAGNOSTIC ULTRASOUND OF THE THYROID AND EXTRACRANIAL HEAD AND NECK

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The American College of Radiology will periodically define new practice parameters and technical standards for radiologic practice to help advance the science of radiology and to improve the quality of service to patients throughout the United States. Existing practice parameters and technical standards will be reviewed for revision or renewal, as appropriate, on their fifth anniversary or sooner, if indicated.

Each practice parameter and technical standard, representing a policy statement by the College, has undergone a thorough consensus process in which it has been subjected to extensive review and approval. The practice parameters and technical standards recognize that the safe and effective use of diagnostic and therapeutic radiology requires specific training, skills, and techniques, as described in each document. Reproduction or modification of the published practice parameter and technical standard by those entities not providing these services is not authorized.

PREAMBLE

This document is an educational tool designed to assist practitioners in providing appropriate radiologic care for patients. Practice Parameters and Technical Standards are not inflexible rules or requirements of practice and are not intended, nor should they be used, to establish a legal standard of care[1]. For these reasons and those set forth below, the American College of Radiology and our collaborating medical specialty societies caution against the use of these documents in litigation in which the clinical decisions of a practitioner are called into question.

The ultimate judgment regarding the propriety of any specific procedure or course of action must be made by the practitioner considering all the circumstances presented. Thus, an approach that differs from the guidance in this document, standing alone, does not necessarily imply that the approach was below the standard of care. To the contrary, a conscientious practitioner may responsibly adopt a course of action different from that set forth in this document when, in the reasonable judgment of the practitioner, such course of action is indicated by variables such as the condition of the patient, limitations of available resources, or advances in knowledge or technology after publication of this document. However, a practitioner who employs an approach substantially different from the guidance in this document may consider documenting in the patient record information sufficient to explain the approach taken.

The practice of medicine involves the science, and the art of dealing with the prevention, diagnosis, alleviation, and treatment of disease. The variety and complexity of human conditions make it impossible to always reach the most appropriate diagnosis or to predict with certainty a particular response to treatment. Therefore, it should be recognized that adherence to the guidance in this document will not assure an accurate diagnosis or a successful outcome. All that should be expected is that the practitioner will follow a reasonable course of action based on current knowledge, available resources, and the needs of the patient to deliver effective and safe medical care. The purpose of this document is to assist practitioners in achieving this objective.

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1 *Iowa Medical Society and Iowa Society of Anesthesiologists v. Iowa Board of Nursing, 831 N.W.2d 826 (Iowa 2013) Iowa Supreme Court refuses to find that the "ACR Technical Standard for Management of the Use of Radiation in Fluoroscopic Procedures (Revised 2008)" sets a national standard for who may perform fluoroscopic procedures in light of the standard's stated purpose that ACR standards are educational tools and not intended to establish a legal standard of care. See also, Stanley v. McCarver, 63 P.3d 1076 (Ariz. App. 2003) where in a concurring opinion the Court stated that "published standards or guidelines of specialty medical organizations are useful in determining the duty owed or the standard of care applicable in a given situation" even though ACR standards themselves do not establish the standard of care.*

I. INTRODUCTION

The clinical aspects contained in specific sections of this practice parameter (Introduction, Indications, Specifications of the Examination, and Equipment Specifications) were developed collaboratively by the American College of Radiology (ACR), the American Institute of Ultrasound in Medicine (AIUM), the Society for Pediatric Radiology (SPR), and the Society of Radiologists in Ultrasound (SRU). Recommendations for physician

requirements, written request for the examination, procedure documentation, and quality control vary between the 4 organizations and are addressed by each separately.

This practice parameter is intended to assist practitioners performing sonographic evaluation of the extracranial head and neck, including evaluation of the thyroid gland, parathyroid glands, parotid glands, submandibular glands, lymph nodes, and adjacent soft tissues. Sonographic evaluation of the major vasculature of the neck is addressed in a separate practice parameter. Occasionally, an additional and/or specialized examination with another modality may be necessary. Although it is not possible to detect every abnormality, adherence to the following practice parameters will maximize the probability of detecting most abnormalities that occur in the extracranial head and neck.

II. INDICATIONS

Indications for an ultrasound (US) examination of the thyroid and extracranial head and neck include, but are not limited to [1]:

1. Evaluation of the location and characteristics of palpable neck masses and thyroid nodules
2. Evaluation of abnormalities detected by other imaging examinations, such as thyroid nodules and/or other neck masses that satisfy criteria for a thyroid ultrasound that are detected on CT, PET, PET/CT, MRI, or other ultrasound examinations (eg, carotid duplex) [1]
3. Evaluation of the presence, size, location, and sonographic features of the thyroid gland [2]
4. Evaluation of congenital hypothyroidism, including search for and characterization of orthotopic and/or ectopic thyroid tissue [3,4]
5. Evaluation of patients at high risk for thyroid malignancy
6. Imaging of previously detected thyroid nodules that meet criteria for follow-up [5]
7. Evaluation of the thyroid gland for suspicious focal pathology prior to neck surgery for nonthyroidal disease [6]
8. Evaluation of the thyroid gland for suspicious focal pathology prior to radioiodine ablation of the gland for hyperthyroidism
9. Evaluation for regional nodal metastases in patients with proven or suspected thyroid carcinoma prior to surgical or other management [7]
10. Evaluation for recurrent locoregional metastatic disease and/or nodal metastases after lobectomy, hemi- or total thyroidectomy for thyroid carcinoma [5]
11. Evaluation of known or suspected thyroid cancer (usually papillary microcarcinoma not undergoing surgical resection) that is being monitored periodically with ultrasound active surveillance/active monitoring for disease progression (eg, increase in nodule size, development of nodal metastatic disease, or extrathyroidal extension)
12. Guidance for aspiration biopsy or other interventional procedure performed on thyroid abnormalities or other neck masses [8,9]
13. Evaluation for causes of relevant laboratory abnormalities, such as abnormalities of parathyroid or thyroid function, elevation of thyroglobulin, hypercalcemia, etc
14. Assessment of the location, number, and size of enlarged parathyroid glands in patients with known or suspected hyperparathyroidism, including patients who have undergone previous parathyroid surgery or ablative therapy who have recurrent signs or symptoms of hyperparathyroidism [10,11]
15. Localization of autologous parathyroid gland implants

16. Evaluation of masses of the parotid and submandibular glands [12,13]

17. Evaluation of nonneoplastic conditions of the parotid and submandibular glands, including, but not limited to, sialolithiasis, infection, and autoimmune processes [14-16]

18. Nodal evaluation, including staging, evaluation of response to therapy, and monitoring after therapy, in select patients with head and neck malignancies, including, but not limited to, head and neck primary squamous cell carcinoma, primary salivary malignancy, and melanoma [17-19]

19. Evaluation for supraclavicular nodal metastasis in patients with lung cancer or other infraclavicular primary malignancies at risk for metastasis [20,21]

20. Nodal evaluation in pediatric patients with cervical lymphadenopathy, including, but not limited to, evaluation for necrosis and abscess formation in the setting of acute lymphadenitis [22,23]

21. Imaging of ultrasound detectable vascular abnormalities (such as vascular tumors and vascular malformations) of the head and neck [24]

22. Evaluation of torticollis in neonates and infants [25] or

23. Evaluation of adult and pediatric head and neck soft tissue masses including, but not limited to, thyroglossal duct cyst, branchial cleft cyst, lymphatic malformation, thymic ectopia/cyst, hemangioma, primary neck masses, including neurogenic tumors (neuroblastoma, schwannoma, neurofibroma), rhabdomyosarcoma, leukemia/lymphoma, metastatic disease (rhabdomyosarcoma, neuroblastoma, thyroid cancer, etc) [26], and phlebectasia [27]

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

See the ACR–SPR–SRU Practice Parameter for the Performance and Interpretation of Diagnostic Ultrasound Examinations [28]

IV. SPECIFICATIONS OF THE EXAMINATION

The written or electronic request for an extracranial head and neck ultrasound examination should provide sufficient information to demonstrate the medical necessity of the examination and allow for its proper performance and interpretation.

Documentation that satisfies medical necessity includes 1) signs and symptoms and/or 2) relevant history (including known diagnoses). Additional information regarding the specific reason for the examination or a provisional diagnosis would be helpful and may at times be needed to allow for the proper performance and interpretation of the examination.

The request for the examination must be originated by a physician or other appropriately licensed health care provider. The accompanying clinical information should be provided by a physician or other appropriately licensed health care provider familiar with the patient's clinical problem or question and consistent with the state scope of practice requirements. (ACR Resolution 35 adopted in 2006 – revised in 2016, Resolution 12-b)

Sonographic evaluations of the neck may be comprehensive or may be problem focused, as appropriate for the patient and clinical scenario. Whenever possible, comparison should be made with prior sonograms and/or other appropriate imaging studies.

A. Thyroid Evaluation

The examination should be performed with the neck in as much hyperextension as tolerated by the patient, with or without a towel or other support under the neck or shoulders. Upright positioning may be helpful in patients who cannot tolerate neck hyperextension in the supine position. The right and left lobes of the thyroid should be imaged in longitudinal and transverse planes. Recorded images should include transverse images of the superior, mid, and inferior portions of the right and left thyroid lobes; longitudinal images of the medial, mid, and lateral portions of both lobes; and a transverse image of the isthmus. The size of each thyroid lobe should be recorded in 3 dimensions: anteroposterior (AP), transverse, and longitudinal. The thickness (AP measurement) of the isthmus on the transverse view should be recorded. Color Doppler can

be used to supplement grayscale evaluation of either diffuse or focal thyroid abnormalities. It is often necessary to extend imaging to include the soft tissues above the isthmus, for example, to evaluate a pyramidal lobe of the thyroid, a thyroglossal duct cyst, or palpable abnormality. Similarly, it is important to visualize components of the gland that extend toward or into the superior mediastinum. In this effort, use of tightly curved array transducers may be helpful. The roles of strain and shear-wave elastography and contrast-enhanced ultrasound (CEUS), although potentially helpful, have not been established definitively. Thyroid abnormalities should be imaged in a way that allows for reporting and documentation of the following:

1. Localized or diffuse parenchymal echotexture (eg, homogeneous versus heterogeneous) and, if relevant, vascularity (hyperemia) of the thyroid parenchyma should be noted [29,30].

2. There are multiple thyroid nodule risk-stratification systems (RSSs) in existence. Images of thyroid nodules should be acquired such that relevant focal nodules can be classified based on whatever RSS is used by the interpreting physician. For example, the ACR Thyroid Imaging, Reporting and Data System (TI-RADS) RSS employs the following sonographic features: composition (solid and/or cystic components); echogenicity; size (in AP, transverse, and longitudinal dimensions); margins (smooth, ill-defined, irregular, or demonstrating extrathyroidal extension); eg, taller than wide); and presence and type of echogenic foci and/or calcifications [8,31,32]. Although the ultrasound features that determine risk in children are the same as those used in adults, to date, none of the RSSs have been specifically endorsed for the pediatric population [9,33,34].
   Examination of relevant neck compartments for adenopathy may be helpful in determining the need for biopsy in the setting of thyroid nodules. Comprehensive evaluation of central and lateral compartment cervical lymph nodes is strongly recommended for patients with known or suspected thyroid cancer [35,36]. This comprehensive evaluation may occur at the time of the initial thyroid ultrasound, the time of an ultrasound-guided biopsy, or as a separate ultrasound evaluation to assist in potential surgical or other management decisions. Institutions are encouraged to have consistent practices to ensure that patients receive a comprehensive nodal evaluation when indicated (see section V.B.).
   In patients who have undergone lobectomy, hemithyroidectomy (lobectomy and isthmectomy), or thyroidectomy, the thyroid bed should be imaged in transverse and longitudinal planes and abnormal solid or cystic masses should be measured and reported. Again, examination of relevant neck compartments and the adjacent soft tissue is important to look for locoregional metastatic disease in the setting of prior thyroid malignancy.
   Patients with known or suspected thyroid malignancy who are undergoing active surveillance or active monitoring with ultrasound must be evaluated for progression (eg, interval increase in surveillance nodule size, development of extrathyroidal extension, multifocal disease, or locoregional nodal metastases) [37-40].

B. Cervical Lymph Node Evaluation

Sonographic examination of cervical lymph nodes may be comprehensive or focused, as appropriate for the patient and clinical scenario. Specific nodes that are imaged and the extent of imaging documentation will vary based on the clinical indication. Please see above for nodal evaluation with respect to thyroid-related indications. The size and location of abnormal lymph nodes should be documented, and suspicious nodal morphology including, but not limited to, calcification, cysts focal echogenic areas that are unrelated to a fatty hilum, and abnormal blood flow should be documented [41]. Round shape and absence of an echogenic hilum, although reported in malignant nodes, are findings with poor specificity in thyroid cancer [42,43]. Location of abnormal lymph node(s) should be documented with annotations and/or enough visual information to be able to describe the location according to the image-based nodal classification system developed by the American Joint Committee on Cancer and the American Academy of Otolaryngology – Head and Neck Surgery, or in a fashion that allows the referring clinician to convert the location of abnormal nodes to that system [44]. Node evaluation should be performed at centers with experienced personnel. Lymph node size varies with nodal compartment (eg, level 2 nodes are often larger than other lateral compartment nodes), and nodal size is often less important in the evaluation of malignancy than

nodal morphology. Enlarged cervical nodes can be seen in lymphoma and other malignancies but are often reactive and are seen in acute and chronic infectious and inflammatory disease processes such as postviral syndromes and Hashimoto's thyroiditis.
In the pediatric population, cervical lymph node size, echotexture, vascularity, and potential nodal suppuration or abscess formation evaluation are important in the evaluation of acute lymphadenitis [22,23].

C. Parathyroid Evaluation
Parathyroid ultrasound helps guide surgical planning by localizing enlarged parathyroid glands in patients with primary hyperparathyroidism and helping to predict single versus multiple gland enlargement. Examination for suspected parathyroid enlargement due to adenomas, hyperplasia, or, extremely rarely, parathyroid carcinomas should include images posterior to and just inferior to the right and left thyroid lobes, typical parathyroid gland locations. In addition to typical locations, enlarged parathyroid glands and parathyroid adenomas may be ectopic, and the examination may need to be extended to include imaging from the hyoid to the sternum and along the carotid sheath. Abnormalities of the thyroid and cervical nodes should be documented because concomitant thyroid and/or cervical node pathology may be contraindications to minimally invasive parathyroidectomy [10,11,45].

The examination should be performed with the neck hyperextended and should include longitudinal images from the right and left carotid arteries to the midline, as well as transverse images from the carotid artery bifurcation superiorly to the thoracic inlet inferiorly. Normal parathyroid glands are often not visualized using available sonographic technology; however, enlarged parathyroid glands may be detected. Gentle compression with the ultrasound transducer, asking the patient to swallow during real-time imaging, and the addition of color Doppler imaging (to evaluate for polar rather than central blood flow that is more typical of lymph nodes) are imaging techniques that may make it easier to identify enlarged parathyroid glands. Parathyroid glands may be located below the clavicles or in the mediastinum, and angling smaller footprint, tightly curved array transducers inferiorly from the sternal notch can aid in diagnosis of enlarged inferior parathyroid glands. Approximately 1% to 3% of parathyroid adenomas may be retrotracheal; instructing the patient to swallow and/or turn their head to the opposite side may be helpful in identifying these ectopic parathyroid glands. Rarely, parathyroid adenomas may be intrathyroidal. When parathyroid abnormalities are visualized, their number, size, measurements in 3 dimensions, and location and relationship to the thyroid gland, if applicable, should be documented [6,46].

D. Parotid and Submandibular Evaluation
Sonographic evaluation of the major salivary glands may be comprehensive or focused, as appropriate for the patient and clinical scenario. The parotid and submandibular glands are evaluated in 2 planes, although anatomic limitations due to the mandible and external ear often require oblique planes. A lower frequency transducer may be helpful to visualize the deep aspects of the parotid gland. Color Doppler may be added, when appropriate, for the evaluation of diffuse or focal abnormalities. Overall echotexture (eg, homogeneous or heterogeneous) and measurements of the parotid and submandibular glands should be performed, when appropriate, such as in the evaluation of autoimmune disease or gland asymmetry. Salivary ductal dilation and calculi should be reported. When possible, a dilated salivary gland duct should be traced to the level of obstruction. Description of focal abnormalities/masses within the salivary glands should include size in 3 dimensions, margins, echogenicity, composition, and internal blood flow. Intraparotid lymph nodes and their morphologic appearance (normal or abnormal) should be reported [47].

E. Sonographic Guidance of Head and Neck Procedures
Sonographic guidance may be used for aspiration and/or biopsy of thyroid/parathyroid/salivary gland abnormalities, lymph nodes, and other masses of the head and neck or for other interventional procedures including, but not limited to, preoperative localization and ultrasound-guided treatment of masses with various ablation methods [48].

V. DOCUMENTATION

Reporting should be in accordance with the ACR Practice Parameter for Communication of Diagnostic Imaging

Findings [49].

Adequate documentation is essential for high-quality patient care. There should be a record of the ultrasound examination and its interpretation. Comparison with prior relevant imaging studies may prove helpful. Images of all appropriate areas, both normal and abnormal, should be recorded. Variations from normal size should generally be accompanied by measurements. Images should be labeled with the patient identification, facility identification, examination date, and image orientation. An official interpretation (final report) of the ultrasound examination should be included in the patient's medical record. Video clips of structures of interest in transverse and longitudinal (or orthogonal planes) may be obtained to supplement static images.

VI. EQUIPMENT SPECIFICATIONS

Equipment performance monitoring should be in accordance with the ACR-AAPM Technical Standard for Diagnostic Medical Physics Performance Monitoring of Real Time Ultrasound Equipment [50].

Extracranial head and neck ultrasound studies are usually conducted with a linear transducer. The equipment should be adjusted to operate at the highest clinically appropriate frequency, realizing that there is a trade-off between resolution and beam penetration. For most patients, mean frequencies of 10 to 14 MHz or greater are preferred, although some patients may require a lower-frequency transducer for depth penetration. For evaluation of deep or large structures, a curved transducer may be necessary. For morphologic evaluation of small, superficial lesions, higher frequency transducers, with a small footprint, may be necessary. Additionally, a small-footprint, tightly curved array transducer may be helpful for evaluation of the inferior aspect of the central neck to evaluate for inferior central or upper mediastinal adenopathy and inferior parathyroid glands (Section V-C). Resolution should be of sufficient quality to evaluate the internal morphology of visible lesions. Doppler frequencies should be set to optimize flow detection. Diagnostic information should be optimized while keeping total sonographic exposure as low as reasonably achievable.

VII. QUALITY CONTROL IMPROVEMENT, SAFETY, INFECTION CONTROL, AND PATIENT EDUCATION

Policies and procedures related to quality, patient education, infection control, and safety should be developed and implemented in accordance with the ACR Policy on Quality Control and Improvement, Safety, Infection Control, and Patient Education appearing under the heading *Position Statement on Quality Control & Improvement, Safety, Infection Control*, *and Patient Education* on the ACR website (https://www.acr.org/Advocacy-and-Economics/ACR-Position-Statements/Quality-Control-and-Improvement).

ACKNOWLEDGEMENTS

This practice parameter was revised according to the process described under the heading *The Process for Developing ACR Practice Guidelines and Technical Standards* on the ACR website (https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards) by the Committee on Practice Parameters – Ultrasound of the ACR Commission on Ultrasound and the Committee on Practice Parameters – Pediatric Radiology of the ACR Commissions on Pediatric Radiology in collaboration with the AIUM, the SPR, and the SRU.

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*Practice parameters and technical standards are published annually with an effective date of October 1 in the year in which amended, revised or approved by the ACR Council. For practice parameters and technical standards published before 1999, the effective date was January 1 following the year in which the practice parameter or technical standard was amended, revised, or approved by the ACR Council.

Development Chronology for this Practice Parameter

1994 (Resolution 23)
Revised 1998 (Resolution 34)
Revised 2003 (Resolution 18)
Amended 2006 (Resolution 35)
Revised 2007 (Resolution 31)
Revised 2013 (Resolution 16)
Amended 2014 (Resolution 39)
Revised 2018 (Resolution 25)
Revised 2022 (Resolution 34)
Amended 2023 (Resolution 2c)